

**Space Science Advisory Committee (SScAC) Report**  
**November 15 - 17, 2004**  
**Newport Beach, CA.**

Mr. Al Diaz  
AA Science Mission Directorate  
NASA  
Washington D.C.

January 11, 2005

Dear Mr. Diaz:

It was a pleasure to meet with you and members of your staff at the Space Science Advisory Committee (SScAC) meeting held November 15 – 17, 2004 in Newport Beach, CA. It was also our delight to have members of the Earth Systems Science and Application Advisory Committee (ESSAAC) meet with us. It was a great opportunity to get acquainted in preparation for the planned merger of the two committees to form the science advisory committee for the Science Mission Directorate. I would like to thank Larry Smarr, the Chair of ESSAAC and Bernard Minster, Deputy Chair, for their leadership and contributions during the meeting.

Our meetings on the first day dealt primarily with the advisory committee issues driven by the reorganization at headquarters. Both the SScAC and the ESSAAC expressed a desire to support a successful transformation of NASA. We believe that an informed mutual understanding of concerns and issues will provide the best foundation of an effective partnership. This joint meeting was a major step forward along this road, and both committees express appreciation to NASA for being supportive in this process.

A recurring question was how to identify new opportunities created by the changes at NASA. This question was clearly the context for our discussions with Ghassem Asrar to identify areas of multidiscipline science that would benefit from the expertise and experience of both the space science and Earth science communities. And it extended to our discussions about the structure of the new advisory committee taking advantage of the different perspectives coming from our different backgrounds and approaches in the operation of the two committees. The recommendations given below reflect a consensus view of the membership of both committees.

The discussions were informed by the excellent presentations describing the division science, status and strategies by Eric Smith, substituting for Anne Kinney, Andy Dantzler, Mary Cleave, Richard Fisher and Jack Kaye. Paul Hertz joined by telephone

and provided a glimpse of the management processes in SMD. Marc Allen, with his customary flair, described the NASA Strategic Roadmapping plans.

Linda Spilker, our lunchtime science speaker, visited us from the Jet Propulsion Laboratory on Tuesday. She brought us up to date on the exciting early science results from the Cassini mission. The committee really enjoys the science break and expresses their gratitude for her outstanding presentation.

Our recommendations and copies of the Subcommittee reports are appended to this letter. The committee is expecting to hear replies to our concerns expressed here at the first meeting of the NASA Science Advisory Committee (NSAC).

As this was the final meeting of the Space Sciences Advisory Committee and my final meeting as chair, I would like to thank you, the outstanding individuals on your staff, and the committee members for a truly extraordinary experience. It has been a great pleasure to share their time and to discuss important issues for the future of science. All are champions of science and it has been my good fortune to work with them. Best of life to you and success to NASA.

Sincerely

Andrew B. Christensen  
Chair, Space Science Advisory Committee

Attachments:  
SSES meeting report  
SECAS meeting report  
Joint OS and SEUS meeting report

## **Recommendations and Findings**

### **The Integrated SScAC and ESSAAC Advisory Structure**

The committee supports the NASA plan for a combining SScAC and ESSAAC into a single Science Mission Directorate (SMD) FACA-chartered top-level committee (provisionally named the NASA Science Advisory Committee – NSAC) to advise the SMD Associate Administrator on scientific and programmatic issues. Each of the three Divisions would have a suitably constituted advisory subcommittee to advise on specific matters within each Division. The committee recognizes that a transition period will be required to evolve from the presently constituted committees to a final state with a balanced representation of members reflecting the scientific disciplines involved.

- **We recommend that the NSAC and its sub-committees be FACA chartered committees.**
- **SScAC recommends that a standing working group composed of advisory committee members be formed jointly with the Exploration Systems Mission Directorate and the Science Mission Directorate to examine cross-directorate issues.**
- **The SScAC recommends that three additional internal working/task groups be formed in the areas of technology, information and data systems, and Education/Public outreach. These standing working groups would be composed of members of the three NSAC subcommittees.**
- **We recommend that the current membership of SScAC and ESSAAC constitute the initial membership of NSAC and its final state arrived at through attrition and appointments as appropriate. At that time, it would be desirable to include both chairs and co-chairs of the subcommittees as members of NSAC.**

### **Exploration Initiative and Basic Science**

Within the formal structure of the current strategic planning process and in other discussions, the NASA science community is working to help formulate a coherent strategy to engage in the Exploration Initiative. The crucial contributions that SMD can make toward enabling the Exploration Vision are themselves enabled by a firm foundation of scientific understanding that is broad-based and balanced. Further strengthening that foundation will similarly enable and perhaps stimulate future initiatives.

- **We recommend that the proposed Joint Science and Exploration Working Group document the linkage between space and Earth science activities and the overall goals of exploration.**

## **Balloon Program**

**Background:** The Balloon Program has returned important scientific results. Balloon missions have contributed to spacecraft missions through instrument development. Balloon missions also have the potential to contribute in essential ways to NASA Strategic Objectives. Finally, balloons have provided a platform for training many of the leaders in Space Science. Recently the Universe Division of the Science Mission Directorate charted a Scientific Ballooning Roadmap Team. The SEUS and OS subcommittees heard their preliminary report at the November 2005 meeting.

The Balloon Roadmap team identified a high-priority need for increased capability for Long-Duration Balloon flights. The long-duration balloon flights (and future ultra-long duration balloon flights) have grown too large and complex to be accommodated in the SR&T program. At present, the only avenue is to compete as a Mission of Opportunity in SMEX and MIDEX competitions. While balloon missions have successfully competed in such a framework, it is not clear to SScAC that this is the optimal mechanism.

- **SScAC recommends that NASA study options for expanding opportunities in the Explorer program that could be inclusive of sub-orbital missions (balloons and sounding rockets) and other Missions of Opportunity. The study, which would be reported to NSAC, would consider**
  1. The delay cost to the Explorer program.
  2. Where is the appropriate place for Missions of Opportunity. Should they be removed from SMEX and MIDEX competitions and only included in a UNEX competition?
  3. Within the fixed budget of the Explorer program, which strategy would maximize the science return per dollar.
  4. The possible impact on the sub-orbital program base of an Explorer option.
  5. Other options for enabling support of UNEX class missions to make use of pending enhanced sub-orbital capabilities (e.g. ULDB, as recommended in a Decadal Survey).

## **Education and Public Outreach (E/PO)**

**Background:** The Education and Public Outreach (E/PO) effort of NASA Space Science has arguably been one of NASA's most successful efforts to engage the public and to inspire the next generation of explorers. The program has been a model demonstrating how to effectively integrate education and public outreach with the space science community's activities. The effectiveness of the program is, in no small measure, the result of strong leadership within the office of the Associate Administrator (AA) and of direct and sustained involvement of scientists in E/PO. Scientists are uniquely capable of

communicating NASA discoveries and research, and their expertise provides scientific integrity, models of discovery, inquiry, and critical thinking – essential attributes of life-long learning. Scientist involvement is the most direct and robust means of sharing the discoveries of NASA and involving the public.

The science community is motivated to participate in the E/PO program by the sense of ownership engendered by mandating E/PO as a key component of all missions and research programs. Thus, keeping scientists intimately and personally involved in the E/PO activities is critically important.

The former Space Science Education Officer (EO) successfully fostered a willingness on the part of practicing scientists to integrate education and public outreach into their science missions. His success was due to strong support by the AA, the EO's firm foundation as a scientist and his recognition by practicing educators as knowledgeable about and supportive of pedagogical issues. Another equally critical element of his success was involving partners that specialized in this area, so that their experience, networks, and leverage could be accessed for effective E/PO programs. In short, the EO had credibility in both camps and was able to build bridges that connected the two.

In the organization as presented to us, the Education Officer for the Science Mission Directorate would report to both the Chief Education Officer and the SMD Associate Administrator, but will not be part of the SMD. Within this organizational framework it is crucial that the Education Officer work with and represent the Earth and Space Science community in EPO and provide leadership, ensuring the continuity of the effective E/PO programs underway within the SMD. It is crucial that the Education Officer continue to have the strong visible support of the SMD AA. SScAC appreciates the AA's efforts to date to sustain an outstanding EPO program.

- **SScAC recommends that the Associate Administrator play a significant role in selecting and supervising the new Education Officer. We believe the Education Officer should have a strong science background and a demonstrable ability to work with the Earth and space science communities.**

## **Hubble Space Telescope**

The Committee was pleased to receive an overview of the activities underway related to the Hubble Space Telescope. Plans for its future of this incredible scientific instrument are of great interest to the NSAC, the NASA science community, and the nation at large. The Committee was especially pleased to hear that a science trade study shall be initiated after a Preliminary Design Review of a robotic servicing mission has been completed.

- **SScAC recommends that preparations begin immediately to task appropriate National Academy committees (CAA and SSB) to undertake studies that assess the scientific impact of various servicing scenarios and encompass a full range of scientific options. We also request a more thorough status**

**report at the next Committee meeting including the proposed schedule for the science review, estimated costs and allocation of costs.**

## **Strategic Planning**

We were encouraged to hear that the Strategic Roadmap objectives are being coupled with NASA's highest level goals and objectives, and are pleased that there is continuing effort to have these goals and objectives encompass the fundamental scientific questions in the earth and space science program. We were also pleased that efforts are being made to retain the so-called "Legacy" content by including participating scientists as co-chairs of the roadmapping committees.

- **SScAC requests that the Strategic Planning teams present preliminary reports for review by NSAC at its March meeting.**

## **James Webb Space Telescope (JWST)**

As we discussed in our September 2004 letter to you, the James Webb Space Telescope—the top priority in the Astronomy Decadal Survey and a vital tool in our efforts to explore the universe—continues to face a significant financial and schedule risk. As part of its contribution to the construction and launch of JWST, ESA has agreed to provide an Ariane V launch at no cost to NASA. Unfortunately, the interagency process required for this approval has not moved forward. The Project Office has told us that schedule impacts could be felt as soon as January 2005. If this launch plan is delayed or abandoned, the cost of JWST will grow significantly. Moreover NASA's relationship with ESA could be damaged at a time when (according to the President's Vision and the Aldridge Commission report) international cooperation is very important for the success of the Space Exploration Initiative.

- **SScAC recommends that the Science Mission Directorate (SMD) aggressively seek interagency approval for the Ariane launch for JWST as a near-term high priority activity.**

## **Technology**

The Space Science Advisory Committee has repeatedly advised the NAC and NASA on the importance of advanced technology developments to enable future space science missions and to enhance their science return. Highly successful, currently operating missions such as the Spitzer Space Telescope, the Chandra X-Ray Observatory, Mars Rovers and many prior missions were enabled by many years of technology investments in detectors, cryogenics, optics, and etc. The effective reduction of > \$100 million per year in the Science Mission Directorate advanced technology portfolio, occasioned by the transfer of budget authority in the reorganization of NASA, represents a significant

deviation from this prudent investment and technology strategy that will surely adversely impact the advancement of space science in the years ahead.

- **SScAC strongly recommends that a robust technology program be established and funded in the SMD to meet the needs of future science missions (space and Earth science). The initial directions of this on-going technology program should reflect the priorities established in the current strategic planning/capabilities assessment process.**
- **SScAC requests that the NSAC be briefed on how SMD intends to make the required low-to-mid TRL technology investments for both the Earth and space science.**

## **Prometheus/JIMO**

The SScAC is very concerned that the Prometheus Program may not support the JIMO mission requirements in favor of an as-yet-unspecified “technology demonstration” mission. The Jupiter Icy Moons Orbiter (JIMO) currently represents the sole focus of NASA Outer Solar System Exploration beyond the Cassini and New Horizons missions. JIMO represents a tremendous increase in capability for exploring the outer solar system, in terms of mobility, instrument power available, and high-speed data downlink to Earth. It will not only revolutionize our understanding of the Galilean satellites of Jupiter, and notably the high-value astrobiology target Europa, but it will also demonstrate capability for expanding the exploration of the outer solar system.

However, under the most recent development schedule, the projected 2021-2022 arrival in the Jupiter system entails a lengthy delay in addressing questions of high scientific priority, and further delay will push Europa exploration beyond the horizon of the NAS decadal survey that gave highest priority to that target for major (non-Mars) missions.

SScAC is increasingly concerned that the JIMO mission design, and the underlying Prometheus power system development, pose a number of very significant technical challenges. The required funding profile to accomplish a JIMO launch by even 2015 with adequate reserves is not defined.

- **SScAC recommends that NASA commit to JIMO as the first Project Prometheus mission.**
- **SScAC recommends that NASA give high priority to a full understanding of both the cost profile required to implement JIMO by 2015, and the technological challenges that must be overcome.**
- **SScAC requests a report of the status of JIMO within Project Prometheus at its next meeting.**

## **Terrestrial Planet Finder**

At our July meeting, the Origins Subcommittee reported on NASA's decision to pursue two separate, sequential Terrestrial Planet Finder (TPF) missions: TPF-C (a coronagraph) and TPF-I (an interferometer). This is potentially an important advance for TPF, and represents a major milestone, as well as a significant change in scope of the mission. It is likely that each of these missions will be comparable to or larger than JWST in cost. This is a major step forward for one of our key astrophysical missions which may have an impact on other parts of the science program.

- **SScAC requests a briefing from the project at its next meeting so as to better understand the technical advances and other factors that led to the decision, as well as the scope and requirements for the two missions.**

## **ATTACHMENTS:**

**TO: Andrew Christensen, Chair, Space Science Advisory Committee**

**FROM: Jonathan I. Lunine, Chair, Solar System Exploration Subcommittee**

**SUBJECT: Solar System Exploration Subcommittee Meeting**

The Solar System Exploration Subcommittee (SSES) of the Space Science Advisory Committee (SScAC) met October 21-22, 2004 at NASA Headquarters. The purpose of this memorandum is to summarize the findings of that meeting and ask SScAC to consider them and transmit its recommendations to Mr. Andrew Dantzler, Director of the Solar System Exploration.

#### Administrative changes

SSES welcomes Andrew Dantzler as acting Director of the Solar System Exploration Division, and Doug McCuiston as Director of Mars Exploration. SSES is also extremely pleased that Dr. James Garvin has been named NASA Chief Scientist, indicating the importance the NASA Administrator places on exploration of the solar system. We look forward to working with all of them during these exciting and challenging times.

SSES, in recognizing the organizational transformation currently taking place within NASA, also wishes to express concern about the multitasking of high-level personnel into several duties simultaneously. SSES believes this will lead, sooner or later, to a detrimental stressing of the system, delays in programming, and burnout of personnel. SSES urges that NASA Headquarters fully staff offices at the program level to better meet the needs of the directorates and their customers.

#### Discovery

Discovery remains the archetypical program of PI-led missions within Solar System Exploration. The return of solar wind samples to the Earth in a crash landing of the Genesis capsule this past September 8 illustrates both the scientific promise and technical/programmatic problems associated with the Discovery Program. SSES was pleased to see the successful launch and initial operations of Messenger on the way to Mercury, as well as the continued nominal operation of Stardust and delivery to the launch site of Deep Impact. However, most of these missions, as well as Kepler now under development, have had significant cost and technical issues, and there have been outright (CONTOUR) and partial (Genesis) technical failures.

SSES is pleased to see that NASA continues to take steps to control cost and reduce risk in the Discovery Program. In particular, the staffing and activation of the new Discovery/New Frontiers Program office at Marshall Space Flight Center is an important step in creating a strong agency managerial presence in this program. We look forward to a dialog with the Program Manager, Todd May, to brief him on our previous Discovery Program findings and discuss his plans for the Program Office.

SSES congratulates NASA on moving forward quickly with selection processes for Discovery missions 11 and 12. We recognize that the timing of the selection process for the following Discovery mission, number 13, may be contingent on the nature of the selections for 11 and 12, as well as budgetary issues with missions currently under development. SSES will revisit these issues in early-to-mid 2005 to assess the ability of the program to control cost and risk, and to maintain the frequent launch rate that is an essential characteristic of the program.

### JIMO

The Jupiter Icy Moons Orbiter (JIMO) currently represents the sole focus of NASA Outer Solar System Exploration beyond the Cassini and New Horizons missions. Under the most recent development schedule, the 2021-2022 arrival in the Jupiter system entails a lengthy delay in addressing scientific questions of high scientific priority, most notably the astrobiological potential of Europa.

SSES is increasingly concerned that the JIMO mission design, and the underlying Prometheus power system development, pose a number of very significant technical challenges. At present, the required funding profile to accomplish a JIMO launch by even 2015 with adequate reserves is poorly understood. SSES encourages the most rapid possible determination of the JIMO cost profile, and its endorsement by NASA and the Congress. SSES plans to examine the status of the JIMO mission at its summer 2005 meeting, after the DOE Office of Naval Reactors presents its reactor feasibility study and Northrup Grumman Space Technologies presents its Phase A design.

SSES strongly urges NASA to develop a robust planning effort for the scientific exploration of the outer planets, as a guide to mission design efforts that might utilize Prometheus technologies and more conventional approaches. This will provide a programmatic strategy for outer solar system exploration with the flexibility to implement missions that address high-priority science issues.

### Mars

The exploration of Mars has achieved a remarkable and unprecedented level of success over the past year. There are five functioning spacecraft at Mars --Mars Global Surveyor, Odyssey, and ESA's Mars Express in orbit, and the MER Opportunity and Spirit rovers on the surface. The two rovers, Opportunity in particular, have discovered unambiguous evidence that Mars was once wet, with large standing bodies of water, and have far exceeded their designed performance in terms of distance traveled and terrains covered. As was hoped, the MER missions have focused Mars exploration from four original pathways to three over the coming decade, which increases the priority of Mars sample return in 2013. SSES urges the Mars Exploration Program (MEP) Office to move aggressively on advanced planning activities to support missions beyond the 2009 timeframe.

We note that the Mars Exploration Program is one of the crown jewels of NASA. As robotic activities leading to the human exploration of Mars ramp up, we urge NASA not to lose focus on the science goals for Mars exploration. Science missions and human precursor missions should take full advantage of possible synergies between the exploration and science programs.

SSES is pleased by the increasing engagement of the astrobiological community in Mars mission planning and activities, and urges NASA to strongly encourage the involvement of the next generation of astrobiologists in mission planning, development and execution.

#### Lunar Reconnaissance Orbiter

Although the goals of the Lunar Reconnaissance Orbiter (LRO) are primarily exploration-driven, the SSES recognizes that these goals are also quite relevant to high-priority lunar science. This is especially true of the important issue of the existence and nature of lunar polar volatiles. Therefore, the SSES concludes that the complement of instruments selected for the LRO mission will most likely contribute substantially to lunar science goals. Many important lunar science goals described in the NRC's Solar System Decadal Survey are not explicitly addressed by LRO, and should be addressed by future lunar missions.

Overall, the SSES is pleased with the linkage between the Exploration and Science Mission Directorates as represented by the LRO mission. It is laudable that measurement data from LRO will be archived in the PDS for use by science investigators, in addition to the exploration community. The SSES believes that the goals of future missions within the Robotic Lunar Exploration Program (RLEP) should be explicit about the important ties between lunar exploration and lunar science, as the two are inherently linked. Preserving these ties is vital to the long-term success of LRO and the RLEP.

#### Planetary Data System

The Planetary Data System (PDS) was established to provide the planetary science community with access to high quality, peer-reviewed datasets, which include calibrations, documentation and other ancillary information. The PDS has experienced difficulties with late deliveries of data products and non-PDS compliant deliveries from flight projects.

SSES commends the PDS efforts to bring products up to compliance and in their efforts to ensure that PDS guidelines are provided in solar system AOs. The SSES was very pleased to see that discussions have begun with the Sample Curation Facility to coordinate archiving of ancillary information related to sample collection in response to our previous recommendations. In response to continued frustrations from the science community with the ease of use of the PDS system and community unhappiness with the management of the system, two evaluations of the PDS Central Node were conducted this past year, and various options are being considered.

SSES strongly supports the idea that the infusion of planetary science understanding in program management is necessary. This could be accomplished either with a scientist high up in the management structure, or with a scientific ombudsman who could act as a liaison between management and the scientific community. There was discussion concerning the purpose of a Central Node in an era of distributed networks, however, the SSES notes that the program office may still have technical functions to fulfill.

#### New Technology Program

Solar System Exploration Division seeks to develop and validate technologies for broad applicability in future missions. However, flight validation of new technologies is often hampered by the high costs required for stand-alone missions. Feeder programs in the former Code R, that supplied basic technology components, have disappeared. NASA is considering the possibility of using existing spacecraft whose primary missions have been accomplished, but which still have available resources, to help validate new technologies where appropriate (e.g., navigation software). This has been done successfully in the Mars Program, and might be extended to include Discovery and New Frontiers missions.

SSES notes two challenges to this approach. First, while technological objectives are legitimate goals of extended operations for scientific missions, these objectives need to be competed against the potential science that extended missions can return. Ideally, the technology demonstrations would enable or enhance scientific observations and data return in the extended mission. Second, in this era of cost-constrained missions, the technology demonstration requirements need to be fully understood and funded by their sponsors, including the full costs of accommodation on the spacecraft and of impacts on mission operations. Otherwise, the primary phase scientific objectives may be impacted or the technological objectives themselves may be compromised. SSES believes that these challenges can be met and encourages NASA to continue to support new technology efforts essential to accomplish its scientific and exploration goals.

Sincerely

A handwritten signature in black ink, reading "Jonathan I. Lunine". The signature is fluid and cursive, with the first name "Jonathan" and last name "Lunine" clearly distinguishable.

Jonathan I. Lunine, Chair



**International, Space, and Response Technologies Division**

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November 7, 2004  
ISR-1-04-137

Dr. Andrew Christensen  
Northrop Grumman Space Technology  
One Space Park, R9-1914  
Redondo Beach, CA 90278

Dear Andy,

The Sun-Earth Connections Subcommittee met in Washington on November 3-5. We had a very busy and productive meeting. A copy of the agenda is attached to this letter.

Since we are aware of the upcoming reorganization of the advisory committee structure, one focus of our meeting was an effort to increase our understanding of the scope and objectives of the Earth Sciences programs, with which Sun-Earth Connections is being merged. We heard presentations by Mary Cleave, Jack Kaye, Greg Williams, and Gordon Johnston that were very helpful in introducing to us the breadth of important activities going on within the Earth Sciences effort. We look forward to discovering and pursuing the opportunities for scientific interchange and collaboration that will be afforded by the new organizational structure. In a similar spirit, we also took a look at what aspects of the existing structure have been helpful to SECAS in carrying out our designated tasks. One thing we have found particularly valuable is our MOWGs, which are essentially sub-subcommittees that provide us with in-depth professional expertise and insights into more narrowly focused parts of the full SECAS purview. One of the findings described below is that a similar structure would also probably well serve the successor to SECAS.

Another important activity at our meeting was a discussion of the ongoing roadmapping process. We heard a presentation by Todd Hoeksema, the chair of our legacy roadmapping committee, on their progress and plans. We were quite pleased with the careful and comprehensive approach they are taking, and we expect the outcome to be a very positive and progressive guide to the future program. In our discussion of the overall process, however, concerns were raised about the interfaces between the various roadmapping teams; specifically, we are concerned that some research areas that do not fit neatly into the defined boxes may fall between the cracks. This concern led us to our

second finding below.

We greatly appreciate the time that Al Diaz spent with us during this meeting. We had a useful and positive interchange of thoughts. In our discussion, he asked us to give him ideas on how we might contribute to making the new structure work effectively, especially in pursuit of the Exploration Initiative objectives. Our response is indicated in our finding number 4. Specifically, we intend to use the roadmap process to delineate the numerous ways in which SEC science can contribute to NASA's Exploration Vision, exploiting unique capabilities that emerge from our foundation of basic scientific understanding of the workings of the Sun-Earth (indeed, Sun-Planets) system. And, because there remain many unanswered questions (some known, some as yet unknown) about this complex system and its importance for human and robotic exploration activities, we must also continue to strengthen the underlying foundation of fundamental physical understanding.

Finally, I would like to call attention to our finding #5. During the course of the meeting, we learned that there may be a way at hand to address our long-standing need for relatively inexpensive access to space, namely in the excess lift capacity of several of the launch vehicles that are already scheduled for NASA payloads. We would very much like to see this possibility explored.

Our full set of findings is attached.

This was the last SECAS meeting for several of our members, whose terms on the committee expire this month (Jeff Forbes, Jim Klimchuk, Dave Klumpar, Dana Longcope, and Bill Matthaeus). We very much appreciate the time and effort they have devoted to this important community service.

Best regards,

Michelle F. Thomsen  
SECAS chair

cc Al Diaz, Mary Cleave, Richard Fisher

attachments

SECAS Findings from 3-5 November 2004 Meeting  
Agenda for 3-5 November 2004 SECAS Meeting

## Summary of SECAS Findings, 3-5 November 2004

### *1. Advisory Committee Structure*

**Issue:** NASA's new Science Mission Directorate is aligning its advisory committee structure with its divisions, including the Earth-Sun System Division. In response to a question from SECAS, Mr. Diaz said that he welcomed comments from the existing committees on how the new structure might function most effectively.

**Background:** SECAS has been well served by discipline-specific MOWGs (Management Operations Working Groups), the chairs of which also serve on SECAS. Each MOWG provides grass-roots information and specific findings that SECAS integrates with other MOWG findings and uses to inform its own discussions and findings. The in-depth expertise of the MOWGs complements and supports the diverse membership of SECAS; such a resource is likely to be even more valuable for its broader-scope successor committee.

**Recommendation:** SECAS recommends that the Earth-Sun System Division retain standing working groups, similar to MOWGs, that report to the Earth-Sun System Subcommittee.

### *2. Coordination of Parallel Roadmapping Activities*

**Issue:** There is a need to assure effective communication between Agency Strategic Roadmapping activities. There are three specific concerns: timing, smooth interfaces between roadmaps, and coordination and exploitation of interdisciplinary opportunities.

**Background:** Within the new Science Mission Directorate, we are now engaged in an Agency Strategic Roadmap activity. Thirteen strategic roadmap teams and sixteen capability roadmap teams are being formed, in general each responsible for an individual NASA Objective. Sun-Solar System Connection (S3C) science is defined by one of these objectives and is relevant to at least two other science roadmaps and a number of capability roadmaps.

**Recommendation:** So that roadmaps will be compatible, consistent, and exploit interdisciplinary opportunities, we recommend that there be effective and timely communication among the roadmapping teams (both legacy and APIO), e.g., via designated liaisons between roadmapping activities.

### *3. Constitution of the Sun-Solar System Roadmap Team*

**Issue:** There is presently a disciplinary imbalance within the membership of the legacy SSSC roadmap committee that presents a gap in expertise in addressing some aspects of Sun-Solar System physics.

**Background:** A discipline-balanced team had initially been selected. However one member with heliospheric research expertise had to step down, leaving the important area

of heliospheric physics with inadequate representation in the planning process.

**Recommendation:** We recommend that one or two additional members from the heliospheric community be appointed to the legacy roadmap team to ensure that there is appropriate coverage of this area.

#### *4. Supporting the Exploration Initiative on A Foundation of Basic Understanding*

**Issue:** There is a strong imperative to maintain progress in basic understanding of the connected Sun-Earth system to enable support of the Exploration initiative and future initiatives.

**Background:** Associate Administrator Al Diaz briefed SECAS on the new Earth-Sun System Division, outlining the Administration's commitment to continuing SEC's strong space science research program, and emphasizing the potential for our discipline to contribute to the scientific basis for Exploration, as well as the potential for Exploration activities to afford opportunities for enhancing scientific research and discovery. He encouraged SECAS to give him feedback on how SEC science can best contribute to the new vision. We were pleased to receive his enthusiastic support for the discovery nature of our research and for the SEC perspective of the fully connected Sun-Earth system. Through the present roadmapping process, we are reviewing our scientific activities to formulate a coherent strategy to engage in the Exploration Initiative. SECAS believes that our community has much to contribute: Comprehensive knowledge and understanding of solar activity, the interplanetary medium, heliospheric energetic particles, and the environments of planets and moons are required for human safety, spacecraft design, and mission planning related to human and robotic exploration of the solar system. These potential contributions clearly build upon the foundation of basic understanding that is being built through a diverse set of programs of scientific exploration: the Solar-Terrestrial Probes line, the LWS Program, the Explorer and Rocket Programs, as well as Theory, Guest Investigator, and Supporting Research and Technology Programs. Such a foundation is also the best way to ensure that this discipline will be able to support future initiatives, as yet unimagined. Therefore, the challenge to our present strategic planning effort is how to exploit and expand existing knowledge to support the Exploration Initiative, while continuing the fundamental exploration needed to build a solid foundation of basic understanding of the connected system of the Sun, Earth, and planets.

**Recommendation:** SECAS urges the Science Mission Directorate to be mindful of the need to maintain and strengthen a broad foundation of basic understanding in order to support effectively the Exploration vision and other future initiatives.

#### *5. Effective Utilization of Excess Payload Capability on NASA Launches*

**Issue:** Access to space is limited and costly. Small and moderate size scientific satellites are particularly difficult to manifest owing to the often-prohibitive cost of obtaining a dedicated launch vehicle. A standard adapter to accommodate secondary payloads within the EELV fairing could alleviate this inefficiency and open the door to more frequent launch opportunities for this class of satellites.

**Background:** The lack of ready access to space for low cost has resulted in suspension (e.g., UNEX) or the near cancellation (e.g. ST-5) of scientifically compelling missions. At the same time, scientific spacecraft being launched to Earth orbit are often smaller and lighter than the launch booster capacity, resulting in potential underutilization of precious launch capability. NASA has no standard secondary payload adapter for use on US

boosters. This is in contrast to the European Ariane launcher, where every launch carries secondary payloads to utilize excess capability. We understand that the DoD Space Test Program has a secondary payload adapter for the EELV under development. However, as far as we know, NASA neither participates in this development, nor has initiated development of its own secondary payload accommodation.

**Recommendation:** SECAS urges NASA to take an active role in the development of a generic capability to utilize excess payload capacity on launch systems when the primary NASA payload does not require the entire capacity, and we request a report on the feasibility of such a development for discussion at our next meeting.

#### *6. International Heliophysical Year*

**Issue:** NASA is encouraged to participate in the programs commemorating the 50<sup>th</sup> anniversary of IGY1957.

**Background:** Worldwide campaigns in geophysics like the International Polar Years in 1888 and 1932 and the International Geophysical Year in 1957 have left a rich legacy of new science discoveries and expanded geophysical measurement capabilities founded on international cooperation. They play a very important role in the development of space science as a discipline and in public recognition of our accomplishments. On the 50<sup>th</sup> anniversary of the last IGY, several new worldwide campaigns are being planned – the International Polar Year (IPY) 2007, the International Heliophysical Year (IHY) 2007 and the Electronic Geophysics Year (eGY) 2007. As in past campaigns, these efforts hold the potential for driving new and innovative ways of viewing and modeling the Sun, heliosphere, geospace and planetary systems that make use of data from multiple satellite missions and distributed sets of ground-based sensors, but place new emphasis on the role of theory, global modeling and data assimilation in producing new knowledge about the global Sun-Earth system behavior. As in previous IGYs, there is a strong emphasis on the Sun-Earth interaction but, in contrast to previous efforts, parallel investigations are envisioned in Sun-planet system research.

**Recommendation:** SECAS recommends that the Science Mission Directorate look into ways to help make the coming IGY programs a success.

**AGENDA - SECAS – NOVEMBER 3-5, 2004**  
**NASA HEADQUARTERS**

**WEDNESDAY, 3 NOVEMBER 2004: Location: HQ MIC6 (6H46)**

0815	Meeting Room Open, Coffee	
0830	Welcome	Michelle Thomsen
0840	Earth-Sun Systems Division	Mary Cleave
0900	Sun-Solar System Connection Update	Richard Fisher
1000	Sun-Solar System Connection Mission Update	Charles Gay
1015	Break	
1030	MOWG reports (15 min each) Living with a Star Geospace Solar-Heliospheric	Glenn Mason Jim Clemmons Steve Suess
1100	Future Advisory Committee Structure	Greg Williams
1130	Introduction to the Earth Science Program	Jack Kaye

1200	Group Lunch: Science Presentation	
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1300	ROSES-2005	Paul Hertz
1315	Solar Terrestrial Probes Update	Eric Christian
1345	Agency Strategic Planning and the SSSC Roadmap	Barbara Giles
1415	Break	
1430	Sun-Solar System Connections Roadmap Update	Jeff Forbes and Todd Hoeksema
1530	Solar System Exploration Roadmap Activities	Nathan Schwadron
1545	Earth Science Roadmap Activities	Gordon Johnston
1600	Roadmap Discussion	Committee
1700	Adjourn	
1830	Group Dinner	

**THURSDAY, 4 NOVEMBER 2004: Location: HQ PRC (9H40)**

0815	Meeting Room Open, Coffee	
0830	International Heliophysical Year/Electronic Geophysical Year	Joe Davila
0900	Sounding Rocket Program Review	Gerry Daelemans
0930	Living with a Star Update	Lika Guhathakurta
1000	Break	
1015	Project Columbia	Tsengdar Lee
1045	Magnetosphere Constellation	Alex Klimas

1115	Lunch on your own – e.g., cafeteria or grill on 1 <sup>st</sup> floor/café on 9 <sup>th</sup> floor	
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	MOVE TO HQ AUDITORIUM	
1200	Science Presentation in the auditorium	George Siscoe
	RETURN TO MEETING ROOM	
1315	Discipline Scientist Roundtable	HQ Discipline Scientists
1400	Science Missions Directorate Update	Al Diaz
1500	Break	
1515	Discussion and Writing Assignments	Committee
1700	Adjourn	
1830	Group Dinner	

**FRIDAY, 5 NOVEMBER 2004: Location: HQ PRC (9H40)**

0815	Meeting Room Open, Coffee	
0830	Committee Writing Time	Committee
0915	Review of Findings	Committee
1030	Break	
1045	Review Findings with Fisher/Cleave	Committee/Fisher/Cleave/Division
1145	Committee roundtable	Committee
1200	Adjourn	

END OF MEETING

Dear Andy:

The Origins Subcommittee met on November 9 and 10 in College Park, Maryland. Much of the meeting was held in joint session with the Structure and Evolution of the Universe Subcommittee.

Anne Kinney briefed the joint Subcommittees on the status of the Universe program. With HST, Spitzer, Chandra and many smaller missions producing exciting science, we are in the midst of a very exciting time for astrophysics.

Marc Allen reviewed the new plans for roadmapping. As NASA restructures its plans, we are all eager to provide useful input in the most effective form.

## **TECHNOLOGY**

**We are very concerned that the disappearance of Aerospace Technology funding within NASA will further exacerbate the problem of developing mid-TRL technologies for Universe Division missions. New detectors, optics, cryocoolers, etc. are needed to implement Origins Probes, Visions Missions, and near-term balloon payloads, explorers, and future SOFIA instruments. Mel Montemerlo put together a very good plan that documents many of these needs and many of the technologies that will be essential to future astronomical missions. The Origins Subcommittee advocates that the Universe Division to outline a plan for bridging this technology funding gap and develop a strategy for long-term technology funding. We request that this plan include new opportunities for high priority technologies in the near future (FY05) and that it be presented at the next meeting with as many details as possible.**

## **DSN**

**Barry Geldzhaler briefed the Origins Subcommittee on plans for upgrading the Deep Space Network. The next generation DSN will have significantly higher bandwidth. For many of the planned OS missions, low operations costs and dependability will be as important as high bandwidth. We recommend that the SscAC review the plans of the DSN to assure that they are matched to the strategic needs of NASA science.**

## **JWST Ariane Launch**

As we discussed in our previous report, the James Webb Space Telescope—the top priority in the Astronomy Decadal Survey and a vital tool in our efforts to explore the universe—continues to face a significant financial and schedule risk. As part of its contribution to the construction and launch of JWST, ESA has agreed to provide an Ariane V launch at no cost to NASA. Unfortunately, the interagency process required for this approval has not moved forward. If this launch plan is slipped or abandoned, the cost of JWST will grow significantly and NASA’s relationship with ESA will be damaged at a time when (according to the President's Vision and the Aldridge Commission report) international cooperation is very important for the success of the Space Exploration Initiative. **We recommend that the SscAC asks the Science Mission Directorate (SMD) to aggressively seek interagency approval for the Ariane launch for JWST as a near-term high priority activity.**

## **TPF-C**

The rapid advances in the development of TPF-C have been one of the exciting developments within the Origins program. Since TPF-C is now scheduled to launch several years ahead of TPF-I, we encourage NASA to make its funding the top priority within the TPF program. **We have several specific recommendations for the TPF-C program: (1) the new STDT be a balanced committee with a significant representation of general astrophysicists; (2) the TPF project work to maximize community involvement by supporting multiple instrument options and groups, and (3) we encourage the TPF project to compete the starlight suppression system in TPF-C.**

## **HST**

Jennifer Wiseman and Colonel M. Borkowski briefed the Origins Committee on progress on the Hubble robotic mission. The planned mission is a very ambitious program and would represent a major advance in robotics. We are concerned that the process of evaluating the costs and science return of the various HST refurbishments options and are also concerned about the impacts of these costs on other parts of the Origins program. We are eager to maximize community involvement in evaluating these trade-offs.

## **Balloons**

Martin Israel briefed the joint Origins/SEUS on the balloon roadmap. The Balloon Roadmap team identified a high-priority need for increased capability for Long-Duration Balloon flights. The long-duration balloon flights (and future ultra-long duration balloon flights) have grown too large and complex to be accommodated in the SR&T program. At present, the only avenue is to compete as a Mission of Opportunity in the Explorer

competitions. The Balloon roadmapping team advocated a special line within the Explorer program for the balloons. However, since the balloon missions have successfully competed in the current framework, the OS did not endorse allocating Explorer funds exclusively for balloons and favors continuing to compete the balloons against other Explorer missions.

## **Roadmapping**

**The OS reviewed and discussed plans for the 2005 NASA roadmap. We are confident that the SEU and Origins roadmaps can be successfully melded into a joint "Universe" roadmap. With the compressed schedule, there is a concern that there will be little time for community interaction in the roadmapping process. The roadmapping teams will need to ensure that there are well-publicized opportunities to present roadmap outlines and elicit community response (e.g., at the AAS meeting in January).**

## **Vision Missions**

The leaders of various Vision Missions briefed the joint Origins and SEU Subcommittees on the interim results of their team studies. The range and scientific potential of these novel missions was very exciting. The OS thanks the team members for their efforts, which will provide useful input for the long-range planning in the roadmap. We encourage NASA headquarters to initiate similar studies in 2008 that will provide input for the NAS decadal survey process.

This is the last report of the OS. We look forward to working more closely with our SEU colleagues as part of the new Universe Subcommittee.

We look forward to working with Anne Kinney in her new role as Director of the Universe Division and with Al Diaz in his new role as Associate Administrator for Science. We want to thank Ed Weiler for his contributions as Associate Administrator and wish him success in his role as Director of Goddard Space Flight Center.

Sincerely yours,

David Spergel, for the Origins Subcommittee